3. GROUNDWATER SAMPLING AND MONITORING DATA QUALITY OBJECTIVES

The objective of this LTMP is to outline the sample collection and monitoring activities to be conducted to monitor the contaminants in the SRPA outside the INTEC fence and to monitor the flux of contaminants in the aquifer across the INTEC security fence. The groundwater monitoring will be performed to meet the SRPA monitoring requirements as stated in the OU 3-13 ROD (DOE-ID 1999). In general, the results from the monitoring will be used to

- Monitor the flux of contaminants in the aquifer across the INTEC security fence in the Group 5
- Validate and/or update the OU 3-13 aquifer numerical model
- Evaluate whether the INTEC groundwater plume in the SRPA outside of the INTEC fence line will meet the Group 5 remedial action objective (RAO) of achieving Idaho groundwater quality standards or risk-based concentrations in the SRPA by 2095.

3.1 Data Quality Objectives

To help with defensible decision-making, the EPA has developed the DQO process, which is a systematic planning tool based on the scientific method for establishing criteria for data quality and for developing data collection designs (EPA 1994). DQOs have been developed to guide monitoring and sampling of the SRPA. The process consists of seven iterative steps that yield a set of principal study questions and decision statements that must be answered to address a primary problem statement. The seven steps comprising the DQO process are listed below:

Step 1: State the problem.

Step 2: Identify the decision.

Step 3: Identify the inputs to the decision.

Step 4: Define the study boundaries.

Step 5: Develop decision rules.

Step 6: Specify limits on the decision.

Step 7: Optimize the design for obtaining data.

The DQOs that govern the Group 5 groundwater sampling and monitoring are presented in the following sections and summarized in Table 3-1. These objectives were negotiated with and have the concurrence of the Agencies.

3.1.1 State the Problem

The WAG 3 ROD requires monitoring activities to determine whether present contaminants in Group 5 or the flux of contaminants originating from within the INTEC security fence will affect the aquifer such that Idaho groundwater quality standards or risk-based concentrations will not be met in Group 5 in 2095.

Table 3-1. Data quality objectives for OU 3-13, Group 5, groundwater.

1: State the Problem	2: Identify the Decision			3: Identify Inputs to the Decision	4: Define the Study Boundaries
	Principal Study Questions:	**Alternative Actions:**	**Decision Statement:**		
Monitor the flux of contaminants in the aquifer across the INTEC security fence and the contaminants in the plume downgradient of the INTEC facility to determine if the Group 5 RAO of achieving Idaho groundwater quality standards or risk-based concentrations by 2095 will be affected by contamination within the INTEC facility.	PSQ-1: Is the COC flux in the SRPA from the contaminated media in the vadose zone beneath the INTEC facility of sufficient magnitude to prevent achieving the Group 5 remediation goals.	No alternative actions required for monitoring program.	DS-1: Determine whether or not the flux of contaminants in the SRPA which originate in the vadose zone within the INTEC security fence line is of sufficient magnitude to exceed the Group 5 remediation goals in 2095.	The inputs to PSQ-1 are: Sampling of selected wells upgradient of, near the boundary of, and within the INTEC security fence line and analysis for COCs. Selected wells will be sampled in the upper 50 ft of the SRPA. Measurement of water table elevations for evaluation of groundwater elevation contours and flow direction. Periodic incorporation of new data and update of the OU 3-13 aquifer numerical model for prediction of COC concentrations in the SRPA at 2095 and beyond	This study will focus on the SRPA beneath the INTEC facility and near the boundary of the facility. The area of focus along the INTEC boundary is the south and west boundaries given the south-southwest direction of groundwater flow in this region. The primary sources of contaminants to the aquifer include both the perched water/vadose zone above SRPA and the former injection well which penetrates the aquifer and HI interbed. Two principal study questions have been identified to evaluate these sources separately.
The OU 3-13 Group 5 is defined as that portion of the SPRA outside of the INTEC security fence where concentrations of COCs exceed current MCLs or risk based concentrations. The remediation goal for OU 3-13, Group 5 is "Achieving the applicable State of Idaho groundwater standards or risk-based groundwater concentrations in the SRPA plume south of the INTEC security fence by the year 2095 (ROD, Sec. 8.1.5, pg 8-10)." To determine if this goal will be met the input of contaminants to Group 5 from the contaminated aquifer within the INTEC security fence must be determined.	PSQ-2: Is the COC flux in the SRPA from the contaminated sediments/sludges remaining in the former Idaho Chemical Processing Plant injection well (CPP-3) and immediate vicinity of sufficient magnitude to prevent achieving the Group 5 remediation goals.	No alternative actions required for monitoring program.	DS-2: Determine whether or not the flux of contaminants in the SRPA from the former INTEC injection well is of sufficient magnitude to exceed the Group 5 remediation goals in 2095.	The inputs to PSQ-2 are: Borehole geophysical and fluid logging of selected wells which penetrate the HI interbed for selection of wells and sampling zones below the HI interbed downgradient of the former injection well. Isolation through packers or other method(s), sampling, and analysis for COCs of selected well zones below the HI interbed downgradient of the former injection well. Measurement of water table elevations for evaluation of groundwater elevation contours and flow direction, and possibly head gradient between aquifer above and below the HI interbed. Periodic incorporation of new data and update of the OU 3-13 aquifer numerical model for prediction of COC concentrations in the SRPA at 2095 and beyond. Note: Isolation of sampling zone(s) beneath the HI interbed depth from selected wells should not preclude also sampling of zone(s) above the HI interbed from the same well to supply inputs for PSQ-1.	The portion of the aquifer that is likely to be affected by contaminants transported through the vadose zone is the upper 50 ft of the aquifer above the HI interbed. Because the former injection well penetrated the HI interbed, the portion of the aquifer potentially affected by the injection well includes both the upper zone from the water table to the HI interbed and the lower zone beneath the HI interbed. The total depth of the former injection well was 598 ft. Accordingly the base of the study boundary should correspond to the total depth of injection, or approximately 600 ft below land surface.
	PSQ-3: Are the COC concentrations in the SRPA outside the INTEC facility at sufficient magnitude to prevent achieving the Group 5 remediation goals.	AA: No alternative actions required for monitoring program.	DS-3: Determine whether or not the COCs in the SRPA outside the INTEC facility will exceed the Group 5 remediation goals in 2095.	The inputs to PSQ-3 are: Sampling of selected wells downgradient of the INTEC security fence and analysis for COCs. Selected wells will monitor the contaminants above the MCLs and monitor the downgradient plume area above the MCLs. Measurement of water elevations for evaluation of groundwater elevation contours and flow direction. Periodic incorporation of new data into the OU 3-13 aquifer numerical model for the prediction of COC concentrations in the SRPA in 2095 and beyond.	Monitoring the concentrations of COCs above and below the HI interbed and as far downgradient as indicated by the detections of COCs above MCLs. Because the remediation goal is established in the year 2095, this study will continue through the institutional control period to at least 2095.

Table 3.1 (continued).

5: Develop a Decision Rule	6: Specify Tolerable Limits on Decision Errors	7: Optimize the Design
If the monitoring activities and model predictions generated for this study indicate that Group 5 RAOs/remedial goals will be exceeded due to the flux of contaminants in the SRPA beneath or downgradient of the INTEC facility, a comprehensive evaluation, focused feasibility study, and ROD amendment will be performed to address the risks posed by groundwater contaminants beneath INTEC and/or downgradient of INTEC. If it is determined that the RAOs/remedial goals will be met, monitoring will continue until 2095 or until the agencies determine that no unacceptable risk exists from Group 5. Note: The decision is based upon model predictions using data obtained from an observational well network to model evolution of the plume.	In this case the decisions will be made by comparing data to computer predictions, the accuracy of the computer predictions will be dependent on the accuracy of the OU 3-13 model.	A flow chart presenting the conceptual design of the WAG 3 Group 5 field activities entitled "Group 5 Snake River Plain Aquifer Flowchart," is shown in Section 1, Figure 1-1. The flow chart details the steps to be taken to both arrive at a contingent remedy decision and to perform the SRPA interim monitoring. The two separate flow paths are identified on the chart. The following paragraphs describe and present the rationale for the design of field activities related to the contingent remedy decision. Thirty six wells are available in the vicinity of INTEC suitable for groundwater monitoring. From that set of wells, eleven are selected for the INTEC facility monitoring program to support PSQ-1, monitoring of the contaminant input from the vadose zone to the SRPA. The PSQ-1 INTEC facility monitoring shall consist of groundwater sample collection from wells located upgradient of, within, and adjacent to the INTEC facility. The wells selected for monitoring include MW-18, USGS 40, USGS 42, USGS 47 through 49, USGS 51, USGS 52, and USGS 122 through USGS 123 (see Section 4, Figure 4-1). One well, USGS 121, was selected upgradient of the contaminant source areas at INTEC to provide background groundwater quality data. Though this well is not directly upgradient of the INTEC facility, it is located nearer to the groundwater flow paths from potential sources of upgradient contamination (TRA or NRF) than other wells and is, in that respect, well suited for providing upgradient water quality data. Several wells were selected inside the INTEC facility (MW-18, USGS 47, USGS 48, USGS 49, and USGS 52) to help distinguish between the possible sources of groundwater contaminants located throughout the INTEC facility. Wells USGS 40, USGS 42, USGS 51, USGS 122, and USGS 123 were selected because they are located along the southern and western boundaries of INTEC. The general direction of groundwater flow beneath INTEC is interpreted to be to the south-southwest. The selected wells considered adequate for the INTEC facility monitoring and no new wells are considered necessary at this time. However, additional wells are currently planned for various other monitoring programs at INTEC. As these wells become available, they will be considered for inclusion into the INTEC facility monitoring program. The three wells selected for monitoring in support of PSQ-2, former injection well monitoring, are USGS-41, USGS-48, and USGS-59 based upon an evaluation of their suitability for monitoring the aquifer below the HI interbed. There are 12 USGS wells in the vicinity of INTEC and the former injection well that penetrate the HI interbed and remain as open boreholes in the aquifer, potentially suitable for long term monitoring of the aquifer beneath the HI interbed (excluding INTEC production wells which are required for facility support and cannot be modified to sample below the HI interbed). The wells are USGS-40 through 49, USGS 51, USGS 52, and USGS 59. These wells are located either cross-gradient or downgradient of the former injection well. An evaluation of available data from and additional geophysical and borehole fluid logging of these wells will be performed to determine if they are suitable for deep sampling and to identify potential zones for sampling. It should be noted that an upgradient monitoring well which penetrates the HI interbed is not available within the existing monitoring well network at INTEC. Well USGS-121 does not penetrate the HI interbed. Production wells CPP-1, CPP-2, and CPP-4 have been drilled through the HI interbed and have perforated well casing both above and below the HI interbed but are of limited use as monitoring wells based upon their required support of INTEC operations. The need for an upgradient monitoring well in this zone will be evaluated after the monitoring program is initiated. If the data obtained from the facility monitoring program indicates that the injection well secondary source may cause or contribute to not meeting the Group 5 RAO/ remediation goals, an upgradient well will be installed for sampling beneath the HI interbed to ensure that an upgradient source is not present. It should also be noted that current plans for OU 3-14 investigation include the installation of monitoring well in the immediate vicinity of the former injection well. As these well(s) become available, they will be incorporated into the INTEC facility monitoring well program to provide additional data in the vicinity of the injection well secondary source. In addition to the above monitoring, one sampling round will be conducted using the entire INTEC monitoring network at the onset of the activities outlined in the LTMP. This sampling event will provide a "snapshot" of the current state of the contamination of the SRPA in the vicinity of the INTEC facility and provide a data set to compare the COC flux monitoring data. In addition, these data will be used to update the OU 3-13 numerical aquifer model. In support of Group 4 activities, groundwater samples collected during the baseline sampling event from USGS-40, -42, -47, -48, -51, -52, -121, -122, -123, and MW-18 will be analyzed for stable isotopes including oxygen, hydrogen, and nitrogen. In addition to the analytes listed below, metals and anions will be included in the semiannual sampling conducted after the baseline sampling. Six wells have been selected for long term monitoring of the INTEC plume beyond the facility boundary in support of PSQ-3. The wells selected for long term monitoring are USGS-57, USGS-67, USGS-112, USGS-113, USGS-85, AND LF3-08. These wells were selected based on a review of the historical data for I-129. However, most of the data used to select these wells for long-term monitoring is from 1990–1991; therefore, the baseline groundwater sampling data will be used to optimize the well locations and the total number of wells for long-term monitoring. Analytes of interest include COCs which currently exist in the SRPA at concentrations exceeding either MCLs or risk based concentrations as well as COCs derived from the modeling which are predicted to potentially cause a future unacceptable risk to the SRPA. Contaminants that currently exceed MCLs or risk based concentrations and will be included in the INTEC facility monitoring program are I-129, H-3, and Sr-90. Contaminants that are predicted by the WAG 3 RI/FS modeling to exceed MCLs or risk based concentrations at a future date and are included in the INTEC facility monitoring program are plutonium and uranium isotopes, Np-237, Am-241, and mercury. Chromium, while listed as a COC, is excluded because it is specifically related to groundwater contamination at TRA. Also, because Tc-99 is a contributor to total beta emitting radionuclides limit and present at significant concentrations in the aquifer beneath INTEC, it is included in the list of analytes for INTEC facility monitoring. To evaluate additional radionuclides that may be present but not accounted for in the modeling, gross-alpha and gross-beta analyses will also be performed. Finally, the list of analytes will be updated through either the exclusion of some analytes or inclusion of additional analytes as analytical data is accumulated or new information regarding contaminant sources is identified. The detection limits for I-129, Sr-90, and tritium required to make the decisions needed concerning the contingent remedy are 0.1 pCi/L, 0.8 pCi/L and 2000 pCi/L, respectively. Sampling and analyses will occur at the following frequency: Year 1 — Semi-Annual (twice per year) — Gross-Alpha/Beta, Hg, tritium, Tc-99, I-129, Sr-90, Plutonium Isotopes (Pu-238, -239, -240, and –241), Uranium Isotopes (U-234, -235, and -238), Am-241, ND-237, Cs-137; metals and anions in semiannual and micropurge sampling only (20 wells). Years 2–7 — Annual — Gross-Alpha/Beta, Hg, tritium, Tc-99, I-129, Sr-90, Plutonium Isotopes (Pu-238, -239, -240, and –241), Uranium Isotopes (U-234, -235, and –238), Am-241, ND-237, Cs-137 Years 8–16 — Biannual (once every two years) — Review and adjust as required Years 17–100 — Once every 5 years — Review and adjust as required Following each sampling event and prior to each CERCLA 5 year review, the new groundwater sampling results will be compared against the OU 3-13 aquifer model predictions to determine if concentrations are above, at, or below the model predicted trends. If the new data indicates the model must be updated, the model will be updated generating new COC concentration predictions. These predictions will be compared against the Group 5 RAO/ remediation goals to determine if they will be exceeded or not. If the data trends exceed model predicted trends and indicate a potential exceedance of the Group 5 RAO/remediation goals, the sampling frequency will revert to annual sampling and progress in a manner similar to the schedule above.

The possibility of COC flux in the SRPA originating from sources within INTEC, either in the vadose zone or in the vicinity of the former INTEC injection well, must be quantified. The concentration of contaminants downgradient of INTEC also needs to be monitored. These data can be used to update and refine the OU 3-13 numerical groundwater model to better predict the state of the aquifer in 2095.

3.1.2 Identify the Decision

This step of the DQO process lays out the principal study questions, alternative actions, and corresponding decision statements that must be answered to effectively address the problem stated above. The remediation goal for OU 3-13, Group 5 is "Achieving the applicable State of Idaho groundwater standards or risk-based groundwater concentrations in the SRPA plume south of the INTEC security fence by the year 2095" (ROD, Sec. 8.1.5, pg 8-10). To determine if this goal will be met, the input of contaminants to Group 5 from the contaminated aquifer within the INTEC security fence and the distribution of contaminants in the aquifer outside the INTEC security fence must be determined. To further assist in this evaluation, the groundwater modeling conducted as part of the OU 3-13 RI/FS will be utilized and refined with data collected under this LTMP.

3.1.2.1 Principal Study Questions. The purpose of the principal study question (PSQ) is to identify key unknown conditions or unresolved issues that, when answered, provide a solution to the problem being investigated. The PSQs for this project are

PSQ-1: Is the COC flux in the SRPA from the contaminated media in the vadose zone within the INTEC security fence of sufficient magnitude to prevent achieving the Group 5 remediation goals?

PSQ-2: Is the COC flux in the SRPA from the contaminated sediments/sludges remaining in the former ICPP injection well (CPP-3) and immediate vicinity of sufficient magnitude to prevent achieving the Group 5 remediation goals?

PSQ-3: Are the COC concentrations in the SRPA outside the INTEC facility of sufficient magnitude to prevent achieving the Group 5 remediation goals?

3.1.2.2 Alternative Actions. Alternative actions are those actions resulting from resolution of the above PSQs. The types of actions considered will depend on the answers to the PSQs.

3.1.2.3 Decision Statements. The decision statements (DSs) combine the PSQs and alternative actions into a concise statement of action. The DSs are

DS-1: Determine whether the flux of contaminants in the SRPA that originate in the vadose zone within the INTEC security fence is of sufficient magnitude to exceed the Group 5 remediation goals in 2095.

DS-2: Determine whether the flux of contaminants in the SRPA from the former INTEC injection well is of sufficient magnitude to exceed the Group 5 remediation goals in 2095.

DS-3: Detemine whether the COCs in the SRPA outside the INTEC facility will exceed the Group 5 remediation goals in 2095.

It is important to realize that the installation of an updated monitoring system and collection of new types of data during the SRPA monitoring might modify the site conceptual model for vadose zone flow and transport beneath WAG 3. If the conceptual model is significantly changed, DS-1 and -2 may need to be reevaluated accordingly.

3.1.3 Identify Inputs to the Decision

This step of the DQO process identifies the informational inputs that are required to answer the DSs made above.

3.1.3.1 Inputs for PSQ-1. PSQ-1 will be answered by collecting data on the COC flux originating in the vadose zone within the INTEC security fence, updating the OU 3-13 aquifer numerical model, and evaluating the predictions of the updated aquifer numerical model for COC concentrations in 2095.

Inputs to PSQ-1 are

1. Samples of selected wells upgradient of, near the boundary of, and within the INTEC security fence line, and analysis for COCs. Selected wells will penetrate the upper 15 m (50 ft) of the SRPA.

2. Measurements of water table elevations for evaluation of groundwater elevation contours and flow direction.

3. Periodic incorporation of new data and update of the OU 3-13 aquifer numerical model for prediction of COC concentrations in the SRPA at 2095 and beyond.

3.1.3.2 Inputs for PSQ-2. PSQ-2 will be answered by collecting measurements of COC flux originating from the former injection well within the INTEC security fence, updating the OU 3-13 aquifer numerical model, and evaluating the predictions of the updated aquifer numerical model for COC concentrations in 2095.

Inputs to PSQ-2 are

1. Borehole geophysical and fluid logging of selected wells which penetrate the HI interbed for selection of wells and sampling zones below the HI interbed downgradient of the former injection well

2. Isolation through packers or other method(s), sampling, and analysis for COCs of selected well zones below the HI interbed downgradient of the former injection well

3. Measurements of water table elevations to contour of groundwater elevations and to determine flow direction, and possibly head gradient between the aquifer above and below the HI interbed

4. Periodic incorporation of new data and update of the OU 3-13 aquifer numerical model for prediction of COC concentrations in the SRPA in 2095 and beyond.

Isolation of sampling zone(s) beneath the HI interbed depth from selected wells should not preclude the sampling of zone(s) above the HI interbed from the same well to supply inputs for PSQ-2.

3.1.3.3 Inputs for PSQ-3. PSQ-3 will be answered by collecting measurements of COCs in the aquifer beyond the INTEC security fence line and by updating the OU 3-13 aquifer numerical model. The inputs to PSQ-3 are

1. Sampling of selected wells downgradient of the INTEC security fence and analysis for COCs. Selected wells will monitor the contaminants above MCLs and monitor the downgradient plume area above MCLs.

2. Measurement of water elevations for evaluation of groundwater elevation contours and flow direction.

3. Periodic incorporation of new data into the OU 3-13 aquifer numerical model for the prediction of COC concentrations in the SRPA in 2095 and beyond.

3.1.4 Define the Boundaries of the Study

This study will focus on the SRPA beneath INTEC, near the boundary of the facility and downgradient of the facility. The area of focus is the south and west boundaries because of the south-southwest direction of groundwater flow in this region.

The primary sources of contaminants to the aquifer include both the perched water/vadose zone above SRPA and the former injection well that penetrates the aquifer and HI interbed. Two PSQs have been identified to evaluate these sources separately.

The portion of the aquifer that is likely to be affected by contaminants transported through the vadose zone is the upper 15 m (50 ft) of the aquifer above the HI interbed.

Because the former injection well penetrated the HI interbed, the portion of the aquifer potentially affected by the injection well includes both the upper zone from the water table to the HI interbed and the lower zone beneath the HI interbed. The total depth of the former injection well was 182 m (598 ft). Accordingly, the base of the study boundary should correspond to the total depth of injection, or approximately 600 ft bgs.

The third PSQ addresses monitoring of contaminants already present in Group 5 downgradient of INTEC. The long-term plume monitoring will monitor the concentrations of COCs as far downgradient of the INTEC facility as indicated by the detection of COCs above MCLs.

Because the remediation goal is established in the year 2095, this study will continue through the institutional control period to at least 2095.

3.1.5 Develop a Decision Rule

This step of the DQO process brings together the outputs from Steps 1 through 4 into a single statement describing the basis for choosing among the listed alternatives. If the monitoring activities and model predictions generated for this study indicate that Group 5 RAOs/remediation goals (RGs)will be exceeded due to the flux of contaminants in the SRPA beneath INTEC, then a comprehensive evaluation, focused feasibility study and ROD amendment will be prepared to address the risks posed by groundwater contaminants beneath INTEC. If it is determined that the RAOs/RGs will be met, monitoring will continue until 2095 or until the agencies determine that no unacceptable risk exists from Group 5.

The decision is based upon model predictions using data obtained from an observational well network to model evolution of the plume.

3.1.6 Specify Tolerable Limits on Decision Errors

This step of the DQO process specifies acceptable limits on decision error. These limits are used to establish performance goals for the data collection design. In this case, the decisions will be made by evaluating computer predictions, and thus, the accuracy of the computer predictions will bound the tolerable limits on the decision errors.

3.1.7 Optimize the Design

A flow chart presenting the conceptual design of the Group 5 field activities is provided in Section 1, Figure 1-1. The flow chart details the steps to be taken to both arrive at a contingent remedy decision and to perform the SRPA interim monitoring. The two separate flow paths are identified on the chart. The following paragraphs describe and present the rationale for the design of field activities related to the contingent remedy decision.

Thirty-six wells that are available in the vicinity of INTEC suitable for groundwater monitoring. From that set of wells, 11 are selected for the INTEC facility-monitoring program to support PSQ-1, monitoring of the contaminant input from the vadose zone to the SRPA. The PSQ-1 INTEC facility monitoring will consist of groundwater sample collection from wells located upgradient of, within, and adjacent to INTEC. The wells selected for monitoring include MW-18, USGS-40, USGS-42, USGS-47 through USGS-49, USGS-51, USGS-52, and USGS-122 through USGS-123 (see Section 2, Figure 2-3). One well, USGS-121, was selected upgradient of the contaminant source areas at INTEC to provide background groundwater quality data. Though this well is not directly upgradient of the INTEC facility, it is located nearer to the groundwater flow paths from potential sources of upgradient contamination (TRA or Naval Reactors Facility) than other wells and is, in that respect, well suited for providing upgradient water quality data. Several wells were selected inside INTEC (MW-18, USGS-47, USGS-48, USGS-49, and USGS-52) to help distinguish between the possible sources of groundwater contaminants. Wells USGS-40, USGS-42, USGS-51, USGS-122, and USGS-123 were selected because they are located along the southern and western boundaries of INTEC. The general direction of groundwater flow beneath INTEC is interpreted to be to the south-southwest. The selected wells are considered adequate for the INTEC facility monitoring and no new wells are considered necessary at this time. However, additional wells are currently planned for various other monitoring programs at INTEC. As these wells become available, they will be considered for inclusion into the INTEC facility-monitoring program.

The three wells selected for monitoring in support of PSQ-2, former injection well monitoring, are USGS-41, USGS-48, and USGS-59, based upon an evaluation of their suitability for monitoring the aquifer below the HI interbed. There are 12 USGS wells in the vicinity of INTEC and the former injection well that penetrate the HI interbed and remain as open boreholes in the aquifer, potentially suitable for long term monitoring of the aquifer beneath the HI interbed (excluding INTEC production wells that are required for facility support and cannot be modified to sample below the HI interbed). The wells are USGS-40 through USGS-49, USGS-51, USGS-52, and USGS-59. These wells are located either cross-gradient or downgradient of the former injection well. An evaluation of available data from, and additional geophysical and borehole fluid logging of, these wells will be performed to determine if the selected wells are suitable for deep sampling and to identify potential zones for sampling. (Note: because these wells are completed with an open borehole, there is a significant possibility that the deeper portions of one or more of these may be obstructed, requiring the selection of an alternate well from the 12 wells identified above). It should be noted that an upgradient monitoring well that penetrates the HI interbed is not available within the existing monitoring well network at INTEC. Well USGS-121 does not penetrate the HI interbed. Production wells CPP-1, CPP-2, and CPP-4 have been drilled through the HI interbed and have perforated well casing both above and below the HI interbed but are of limited use as monitoring wells based upon their required support of INTEC operations. The need for an upgradient monitoring well in this zone will be evaluated after the monitoring program is initiated. If the data obtained from the facility monitoring program indicates that the injection well may cause or contribute to not meeting the Group 5 RAO/RGs, an upgradient well will be installed for sampling beneath the HI interbed to ensure that there is no upgradient contaminant source present. Also, current plans for OU 3-14 investigation include the installation of a monitoring well in the immediate vicinity of the former injection well. As the additional well(s) become available, they will be incorporated into the INTEC facility monitoring well program to provide additional data in the vicinity of the injection well.

In addition to the above monitoring, one sampling round will be conducted using the entire INTEC monitoring network at the onset of the activities outlined in this LTMP. This baseline sampling event will provide information on the current state of the contamination of the SRPA in the vicinity of INTEC and provide a data set to compare the COC flux monitoring data. These data will be used to update the OU 3-13 numerical aquifer model. In support of Group 4 activities, groundwater samples collected during the baseline sampling event from USGS-40, -42, -47, -48, -51, -52, -121, -122, -123, and MW-18 will be analyzed for stable isotopes including oxygen, hydrogen, and nitrogen.

Micropurge samples will be collected from the 20 wells in the semiannual sampling event in the first year. In addition to the analytes listed below, the semiannual and micropurge samples will be analyzed for metals and anions. The standard and micropurge data will be compared statistically and based on historical data. Statistical equivalency will be determined by doing a student t-test on the data and by looking at historical data to see if the data falls within historical trends. To determine equivalency based on the T statistic, the null hypothesis, H_o, assumes that the true mean difference is zero and is tested by comparing the t statistic to the appropriate tabled t value. If $T < -t_{\alpha/2,n-1}$ or $T > t_{\alpha/2,n-1}$, where α is the level of significance and n is the degrees of freedom, then null hypothesis is rejected and it is concluded that the true mean difference is significantly different from zero. If $T > -t_{\alpha/2,n-1}$ and $T < t_{\alpha/2,n-1}$, then null hypothesis is accepted and it is concluded that there is not enough evidence to suggest that the true mean difference is significantly different from zero. The hypothesis testing will be conducted to a confidence level (α) of 0.05 or the probability of rejecting the null hypothesis when it is in fact true is 5%.

Six wells have been selected for long-term monitoring of the INTEC plume beyond the facility boundary in support of PSQ-3. The wells selected for long-term monitoring are USGS-57, USGS-67, USGS-112, USGS-113, USGS-85, and LF3-08. These wells were selected based on a review of the historical data for I-129. However, most of the data used to select these wells for long-term monitoring is from 1990–1991; therefore, the baseline groundwater sampling data will be used to optimize the well locations and the total number of wells for long-term monitoring.

Analytes of interest include COCs that currently exist in the SRPA at concentrations exceeding either MCLs or risk-based concentrations, as well as COCs derived from the modeling, which are predicted to potentially cause a future unacceptable risk to the SRPA. Contaminants that currently exceed MCLs or risk-based concentrations and will be included in the INTEC facility monitoring program are I-129, Sr-90, and tritium. Contaminants that are predicted by the WAG 3 RI/FS modeling to exceed MCLs or risk-based concentrations at a future date, and are included in the INTEC facility monitoring program, are plutonium and uranium isotopes, Np-237, Am-241, and mercury. Chromium, while listed as a COC, is excluded here because it is specifically related to groundwater contamination at TRA. Because Tc-99 is a contributor to the total beta-emitting radionuclide limit and is present at significant concentrations in the aquifer beneath INTEC, it is included in the list of analytes for INTEC facility monitoring. To evaluate additional radionuclides that may be present but not accounted for in the modeling, gross-alpha and gross-beta analyses will also be performed. Finally, the list of analytes will be updated through either the exclusion of some analytes or inclusion of additional analytes as analytical data is accumulated or new information regarding contaminant sources is identified. The detection limits for I-129, Sr-90, and tritium required to make the decisions needed concerning the contingent remedy are 0.1 pCi/L, 0.8 pCi/L, and 2,000 pCi/L, respectively.

Sampling and analyses will occur at the following frequency:

Year 1	Baseline 47 Wells Semiannual and Micropurge 20 Wells	tritium, Tc-99, I-129, Sr-90, plutonium isotopes, uranium isotopes (U-234, -235, and -238), Am-241, Np-237, Cs-137, gross-alpha/beta, and mercury; Metals and Anions in semiannual and micropurge sampling only.
Years 2–7	Annual 20 Wells	tritium, Tc-99, I-129, Sr-90, plutonium isotopes, uranium isotopes (U-234, -235, and -238), Am-241, Np-237, Cs-137, gross-alpha/beta, and mercury
Years 8–16	Biannual	Review and adjust as required
Years 17–100	Once every 5 years	Review and adjust and required.

Following each sampling event and prior to each CERCLA 5-year review, the new groundwater sampling results will be compared against the OU 3-13 aquifer model predictions to determine how concentrations compare to the model predicted trends. If the new data indicates the necessity, the model will be updated, generating new COC concentration predictions. These predictions will be compared against the Group 5 RAO/RGs to determine if they will be exceeded. If the data trends exceed model predicted trends and indicate a potential to exceed the Group 5 RAO/RGs, the sampling frequency will revert to annual sampling and progress in a manner similar to the schedule above.

3.1.8 DQO Summary

A summary of the DQOs is presented in Table 3-1.

3.2 Sampling Objectives

The purpose of the groundwater monitoring and sampling is to collect data to determine if the remediation goal for OU 3-13, Group 5 of "Achieving the applicable State of Idaho groundwater standards or risk-based groundwater concentrations in the SRPA plume south of the INTEC security fence by the year 2095" (ROD, Sec. 8.1.5, pg 8-10) will be met. The monitoring and sampling will quantify the input of contaminants to Group 5 from the contaminated aquifer within the INTEC security fence.

In addition to investigating the Group 5 RAOs, a comprehensive round of groundwater samples will be collected from the INTEC monitoring well network to provide a "snapshot" of the present state of contamination within the SRPA in and around the INTEC facility. These data will be used for several purposes, including a comprehensive review/update of the aquifer conceptual model and numerical model predictions.

3.3 Data Reporting

Data will be collected and validated per procedures identified in the QAPjP (DOE-ID 2000a). Analysis reports will be prepared and issued according to the schedule presented in Table 3-2.

Table 3-2. Reports that are projected to be generated.

Report Type	Contents
Annual report	Groundwater chemistry Water level trend data
Monitoring Report Decision Summary	Groundwater chemistry Water level trend data Recharge Contaminant flux to SRPA estimations Update groundwater modeling if necessary
CERCLA 5-yr Review	Data summary Evaluation of data to determine if RAO/RGs will be met Update groundwater modeling if necessary